



# Exercise and hypertension

**BACKGROUND** Exercise is advocated for the prevention, treatment and control of hypertension. However, the treatment effect of exercise on hypertension is difficult to determine as many studies are poorly controlled and involve small sample sizes.

**OBJECTIVE** This article reviews current knowledge about exercise and blood pressure (BP), and provides a guideline for exercise prescription that considers the health status and age of the patient.

**DISCUSSION** An evidence based literature analysis by the American College of Sports Medicine indicates that an isolated exercise session (acute effect) lowers BP an average of 5–7 mmHg. Depending upon the degree the patient's BP has been normalised by drug therapy, regular aerobic exercise significantly reduces BP the equivalent of 1 class of antihypertensive medication (chronic effect). For most hypertensive patients exercise is quite safe. Caution is required for those over 50 years of age, and those with established cardiovascular disease (CVD) (or at high CVD risk) and in these patients, the advice of a clinical exercise physiologist is recommended.

Approximately 29% of Australians have blood pressure (BP) above the recommended level of <120 systolic and <80 diastolic. These individuals account for 8.6% of patient encounters and 7.9% of prescriptions in general practice.<sup>1</sup> As the population ages, these statistics will increase. Over 50% of adults aged 55–74 years already have BP outside the desirable range (Table 1). An individual with normal BP at 55 years of age has a 90% lifetime risk of developing high BP.<sup>2</sup> Costs associated with drugs, pathology, radiology and complications due to stroke, coronary heart disease, kidney disease, heart failure, and end stage renal disease<sup>3</sup> makes hypertension the third greatest modifiable medical risk factor burden in Australia, second only to tobacco smoking and physical inactivity.<sup>4</sup> For this reason, lifestyle modifying treatments, including diet and physical activity, are first line interventions for high BP management, even when drug therapy is implemented.<sup>5,6</sup>

There is little debate that exercise is as important as pharmacologic intervention for many medical conditions.<sup>7</sup> Yet, while medical students spend years learning about how to prescribe drugs, they are rarely instructed on the value of the exercise prescription for various medical conditions, or how to prescribe it.<sup>8</sup>

## The hypertension-exercise relationship

Epidemiologic studies suggest that the relationship between sedentary behaviour and hypertension is so strong that the National Heart Foundation,<sup>5</sup> the World Health Organisation and International Society of Hypertension,<sup>9</sup> the United States Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure,<sup>6</sup> and the



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American College of Sports Medicine (ACSM)<sup>10</sup> have all recommended increased physical activity as a first line intervention for preventing and treating patients with prehypertension (systolic BP 120–139 mmHg and/or diastolic BP 80–89 mmHg). The guidelines also recommend exercise as a treatment strategy for patients with grade 1 (140–159/80–90 mmHg), or grade 2 (160–179/100–109 mmHg) hypertension (*Table 2*). Physical activity is particularly appealing because it has favourable effects on other cardiovascular disease (CVD) risk factors. It is a low cost intervention with few adverse side effects if undertaken according to recommended guidelines.<sup>11</sup>

### How much can exercise lower BP?

The 2004 ACSM review of evidenced based literature on the BP-exercise relationship<sup>11</sup> suggests the following important conclusions for the GP to consider:

- A lifestyle of physical activity can reduce the risk of developing hypertension. Inactive individuals have a 30–50% greater risk than their more physically active counterparts for developing high BP as they age. Therefore, an active lifestyle has an important preventive effect
- Two types of endurance exercise effects are significant – acute effects and chronic effects
  - acute effects: there is an average reduction in

BP of 5–7 mmHg immediately after an exercise session. This is referred to as postexercise hypotension (PEH). While PEH occurs in both normotensive and hypertensive patients, a greater PEH is seen in hypertensives. The PEH effects can occur for up to 22 hours regardless of the exercise intensity

– chronic effects: the average BP reduction with regular endurance exercise for hypertensives not normalised by drug therapy in the literature review is 7.4/5.8 mmHg. If baseline BP is normal because of drug therapy, the average decrease was an additional 2.6/1.8 mmHg irrespective of drug therapy type. The studies used a variety of endurance based programs involving walking, jogging or cycling of moderate intensity (30–90% of VO<sub>2</sub> reserve) ranging from 4–52 weeks in length. Sessions typically lasted 30–60 minutes

- Overall, resistance training has a favourable chronic effect on resting BP, but the magnitude of the BP reductions are less than those reported for an aerobic based exercise program.<sup>12</sup> As well, limited evidence suggests that resistance exercise training has little PEH effect.

These decreases in BP do not seem to be large, but as the ACSM point out, a 2 mmHg reduction in systolic and diastolic BP reduces the risk of stroke

**Table 1. Australian population statistics for hypertension, cholesterol and overweight<sup>20</sup>**

Age group in years	Hypertensive (%)		Total cholesterol of 5.5 mmol/L or more (%)		Overweight (%)	
	Men	Women	Men	Women	Men	Women
25–34	7.1	3.4	32.2	31.2	61.1	35
35–54	21.6	14.9	58	46.5	68.1	51.5
55–74	58.5	55.8	58.3	72.5	74.1	67.8
75+	78.8	74.6	49.3	65.4	63.6	52

**Table 2. Definition and classification of BP levels (mmHg)<sup>5</sup>**

Category	Systolic	Diastolic	Action
Normal	<120	<80	Encourage lifestyle modification if sedentary
High normal*	120–139	80–89	Lifestyle modification
Grade 1 (mild)	140–159	90–99	Lifestyle modification
Grade 2 (moderate)	160–179	100–109	Lifestyle modification
Grade 3 (severe)	≥180	≥110	Lifestyle modification
Isolated systolic hypertension	≥140	<90	Lifestyle modification

\*High-normal has been labelled as prehypertension<sup>6</sup>

by 14% and 17%, and the risk of coronary artery disease by 9% and 6% respectively. The Heart Foundation's *Hypertension management guide for doctors* states that fewer than 50% of patients treated for hypertension will achieve an optimal response with a single antihypertensive medication,

and that in the majority of cases 2 or 3 agents from different therapeutic classes will be required.<sup>5</sup> As an example of the effects of drug therapy on hypertension, the product information for irbesartan quotes mean decreases in BP (based on 7 major placebo controlled 8–12 week studies in patients with

**Table 3. How to prescribe exercise to hypertensive patients based on health status and age<sup>21</sup>**

Patient category	Column A	Column B	Column C
	<ul style="list-style-type: none"> <li>• Prehypertensives with no suspected CVD &lt;50 years</li> <li>• Grade 1 hypertensives &lt;50 years</li> </ul>	<ul style="list-style-type: none"> <li>• Prehypertensives with suspected CVD</li> <li>• Prehypertensives &gt;50 years with no suspected CVD</li> <li>• Grade 2 hypertensives with no suspected CVD &lt;50 years</li> </ul>	<ul style="list-style-type: none"> <li>• Hypertensives with no suspected CVD &gt;50 years</li> <li>• Hypertensives with suspected CVD</li> </ul>
Exercise testing and monitoring	Not necessary	Recommended	Recommended
Exercise type	<p>Aerobic activities: walking, jogging, cycling, swimming</p> <p>Resistance training for retaining muscle mass</p> <p>Monitoring not necessary, but suggest they seek advice from a clinical exercise physiologist for a conditioning and aerobic based training program</p>	<p>Walking, cycling until medically evaluated</p> <p>Send to clinical exercise physiologist for conditioning and aerobic training advice</p> <p>Monitoring probably not necessary unless patient has been sedentary for a number of years and feels uncomfortable about exercise</p> <p>Resistance training for muscle maintenance</p>	<p>Low impact activities such as walking, cycling, swimming</p> <p>Resistance training for muscle maintenance</p> <p>Send to clinical exercise physiologist for monitored conditioning program</p> <p>Follow aerobic training program designed by a clinical exercise physiologist. Periodic monitoring may be necessary</p>
Frequency	6–7 days/week	5–7 days/week	5–7 days/week
Intensity	<p>Start with 20–30 minutes continuous aerobic activity at comfortable pace (50–65%) of maximum heart rate for 3–4 weeks for general conditioning</p> <p>Then exercise at up to 85% of maximum heart rate</p> <p>Maintain an endurance based resistance training for muscle maintenance</p>	<p>Work at light-moderate intensity until evaluated and conditioned</p> <p>Then undertake a maintenance aerobic program at up to 85% of maximum heart rate</p> <p>Maintain an endurance based resistance training for muscle maintenance</p>	<p>Light-moderate. Lower intensity can start with 20–30 mins/day of continuous activity then build to 45–60 mins/day</p> <p>Maintain an endurance based resistance training for muscle maintenance</p>
Duration	Aim for 30–60 mins/day (minimum 150 mins/week of aerobic activity)	Start with 20–30 mins/day of continuous activity. Build to 30–60 mins/day	Start with 20–30 mins/day of continuous activity. Build to 30–60 mins/day (minimum 150 mins/week)
Weight problems	For patients who are overweight, emphasise weight reduction through diet modification. Goal is 60 mins/day of aerobic exercise. Suggest alternating aerobic activity type to avoid injuries. Emphasise endurance resistance training of 3 sets of 12–15 repetitions. Do not make resistance training main exercise. It is important not to hold breath while lifting weights		

a baseline diastolic BP of 95–110 mmHg) compared to placebo after 6–12 weeks as:

- 7.5–9.9/4.6–6.2 mmHg for the 150 mg dose, and
- 7.9–12.6/5.2–7.0 mmHg for the 300 mg dose.<sup>13</sup>

### Why exercise has a reducing effect on BP

How physical activity positively affects BP is not known. One theory is that physical activity improves endothelial function. The endothelium lining of blood vessel walls maintains normal vasomotor tone, enhances fluidity of blood, and regulates vascular growth.<sup>14</sup> Abnormalities in these functions contribute to many disease processes including angina, myocardial infarction, coronary vasospasm, and hypertension.

Another theory proposes that exercise enhances shear stress (a force acting parallel to blood vessels)<sup>14</sup> stimulating the production of nitric oxide (NO) by the endothelium. In healthy blood vessels NO enhances smooth muscle relaxation and maintains the blood vessel in the normal resting state.<sup>15</sup> Small changes in vessel diameter profoundly impacts vascular resistance.

There are also vascular structural changes such as increased length, cross sectional area, and/or diameter of existing arteries and veins in addition to new vessel growth.<sup>11</sup> Endurance trained subjects, for example, have larger arterial lumen diameter in conduit arteries than untrained controls.<sup>16</sup> Aerobic based training also appears to increase large artery compliance.

**Table 4. Classification of physical activity intensity based on physical activity lasting up to 60 minutes<sup>21</sup>**

Intensity	% maximum heart rate*
Very light	<35
Light	35–54
Moderate	55–69
Hard	70–89
Very hard	>90
Maximal	100

\*Maximum heart rate can be estimated by 220–age

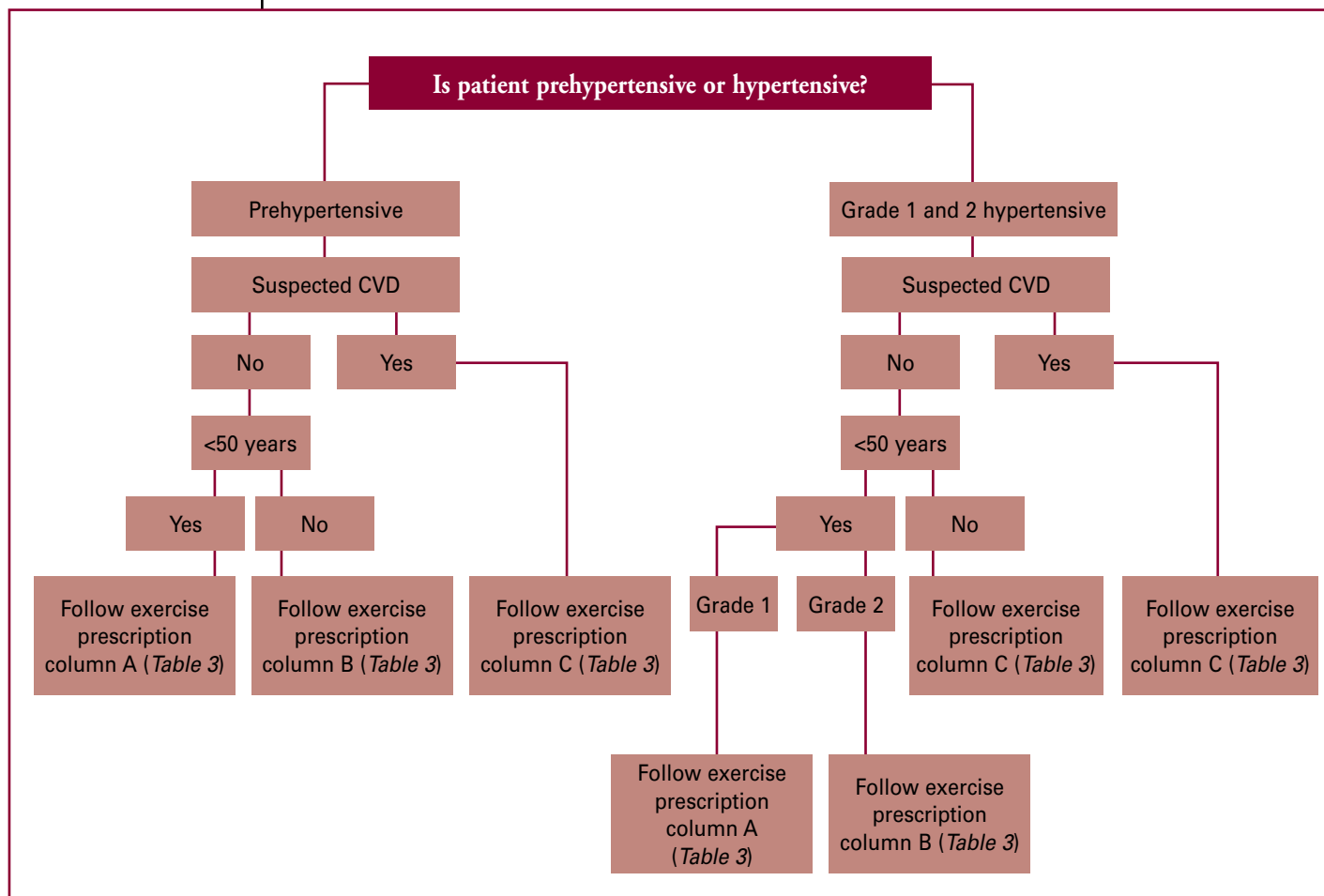


Figure 1. Flow chart for selecting a suitable exercise prescription for hypertensive patients

According to ACSM,<sup>11</sup> physical activity may also reduce the elevated sympathetic nerve activity that is common in essential hypertension. The exact mechanism for PEH remains unclear, but appears to involve the arterial and cardiopulmonary baroreflexes. Studies suggest that the operating point of the arterial baroreflex is set to a lower BP after an acute bout of exercise.<sup>17</sup>

### How to prescribe exercise

To determine the type of exercise you should prescribe for hypertensive patients, use the flow chart in *Figure 1* and then consult the appropriate column in *Table 3*. Your advice depends on the patient's age, BP and overall CVD risk. Based on the literature review, ACSM recommends the following guidelines.

#### Type of exercise

Rhythmical and aerobic exercise involving large muscle groups is the preferred treatment strategy (walking, running, cycling, swimming) for all hypertensive patients. Moderate intensity exercise (50–65% of maximum heart rate) on most days of the week for at least 30–60 minutes appears optimal. A brisk walking pace is moderate; jogging or running is vigorous. Resistance training can be prescribed as an adjunct to aerobic activity as this type of exercise helps maintain and build muscle mass, especially in an aging body. However, resistance exercise should not serve as the primary exercise program as it does not have the same antihypertensive effects as aerobic exercise.<sup>11</sup>

#### Assessment before commencing exercise

Most prehypertensive and grade 1 hypertensive patients can safely begin a moderate intensity exercise program without extensive medical screening.<sup>18</sup> Patients with grade 2 hypertension and no signs of CVD must have their BP controlled before they begin an exercise program. Patients with risk factors for CVD and patients over 50 years of age will benefit from a stress test to determine how their heart responds to exercise. An exercise systolic BP higher than 220 mmHg, or diastolic BP higher than 100 mmHg is considered abnormal. Some with treated hypertension may also have an exaggerated BP response to exercise that is associated with increased CVD risk. Such individuals require a cardiac

evaluation followed by a training program designed and monitored by a certified clinical exercise physiologist.

Patients over 50 years of age will require additional evaluation, as at least half will be overweight, and/or will have high cholesterol (*Table 1*); 40–50% will have heart, stroke and/or vascular conditions; and around 50% will have led a sedentary lifestyle and be at high risk for CVD.<sup>19</sup> Theoretically these individuals should be placed under medical supervision in dedicated rehabilitation centres where they can receive education about exercise, and their physiological reactions to exercise monitored until they have some minimum level of conditioning. However, dedicated rehabilitation centres are generally only available in major cities. They are also usually used for postcardiac event patients and not readily accessible to other patient populations. An alternative is to arrange for the patient to have a stress test, or stress echo, and consult with a cardiologist. After you have this information send the patient to a gym where there is a resident clinical exercise physiologist on staff for education about their health condition and how an exercise program can improve it. The clinical exercise physiologist should also design an ongoing aerobic based training program for the patient to pursue after achieving a minimal level of conditioning. While formal education and base conditioning is taking place, most patients can begin light-moderate exercise such as walking. Note that beta blockers diminish the heart rate response to exercise, therefore patients taking these agents should use the perceived level of exertion (*Table 4*) rather than target heart rate.

### Conclusion

Although it can be difficult to motivate patients to exercise regularly, the benefits of exercise equate to the effects of drug treatment and should be vigorously encouraged. If the exercise program is designed correctly, it is quite safe for most hypertensive patients and also has other important health benefits relevant to their CVD risk factors. It is therefore important to prescribe exercise for patients who have hypertension, or are at risk of getting hypertension, with the same consideration as prescribing any other effective treatment.

### Summary of important points

- Aerobic exercise plays an important role in BP control, and patients should be vigorously encouraged to exercise.
- Blood pressure drops of about 5–7 mmHg can be obtained with exercise which may reduce the need for medication.
- Exercise is a low cost option and also has other significant health benefits.
- For most hypertensive patients, exercise is quite safe but caution is required for those with identified cardiac risk factors. A clinical exercise physiologist can help educate these patients about their health condition and prescribe a program of suitable exercise.

### Resource

For help in finding a certified exercise clinical physiologist visit the Australian Association for Exercise and Sport Science website at: [www.aeess.com.au](http://www.aeess.com.au)

Conflict of interest: none declared.

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